Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supplementary information

Peroxymonosulfate (PMS) activation on cobalt-doped TiO_2 nanotubes: Degradation of organics under dark and solar light-irradiated conditions

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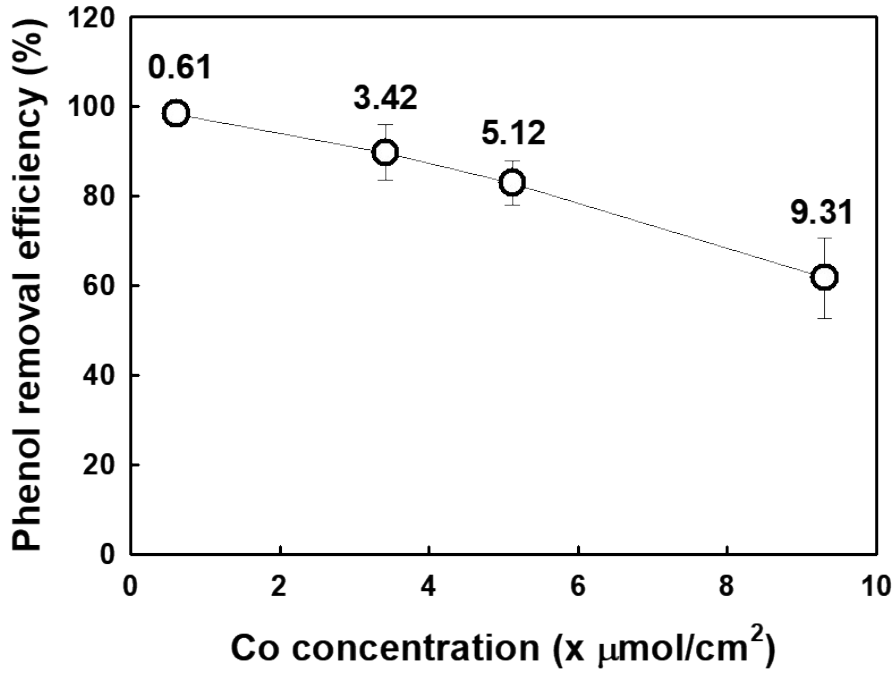


Fig. S1. Phenol removal efficiencies in the Co-TNT/PMS system under solar light irradiation as a function of the Co concentration in Co-TNT. ($[Phenol]_0$ = 100 μM; $[PMS]_0$ = 1 mM; $[phosphate\ buffer]_0$ = 3 vol %; pH_i = 7.0).

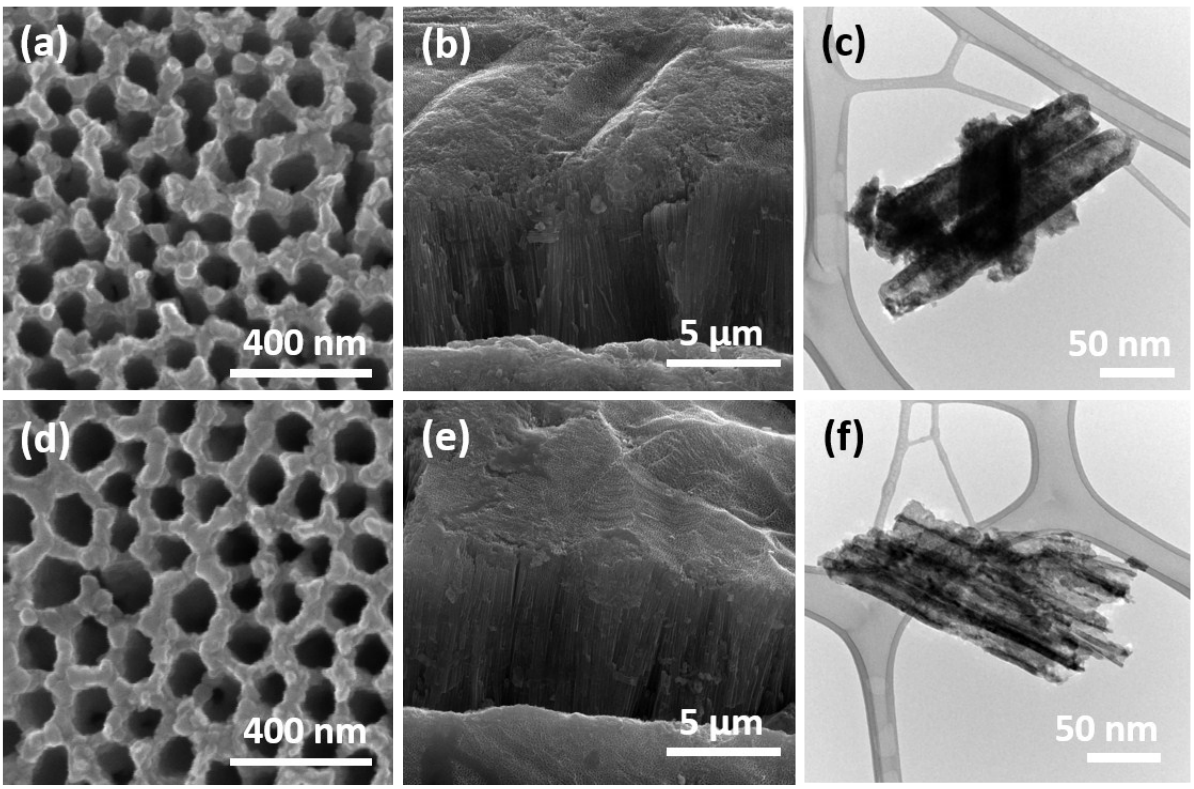


Fig. S2. The horizontal and cross-sectional SEM and HR-TEM images of (a-c) bare TNT and (d-f) Co-TNT.

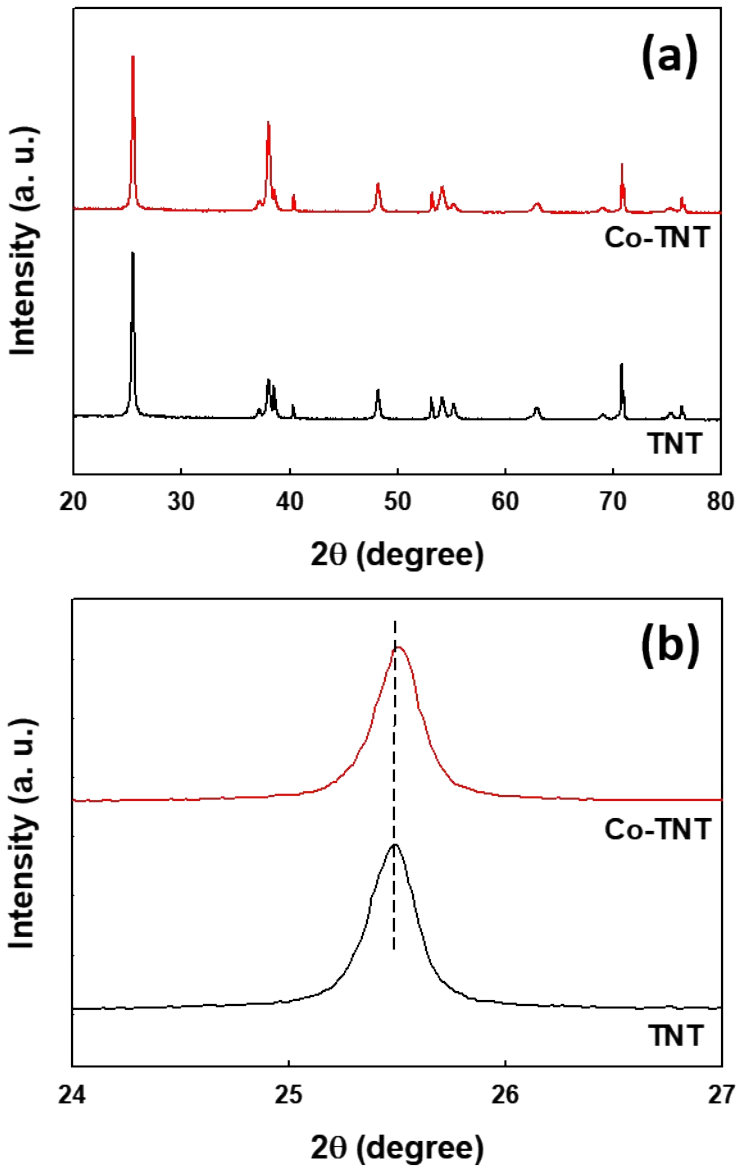


Fig. S3. (a) XRD spectra (b) expanded XRD spectra of (101) diffraction peaks of bare TNT and Co-TNT.

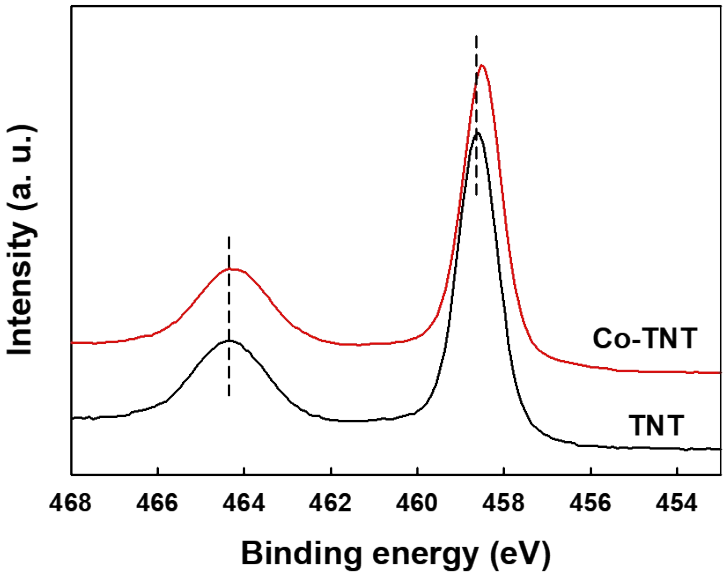


Fig. S4. Ti 2p XPS spectra of bare- and Co-TNT.

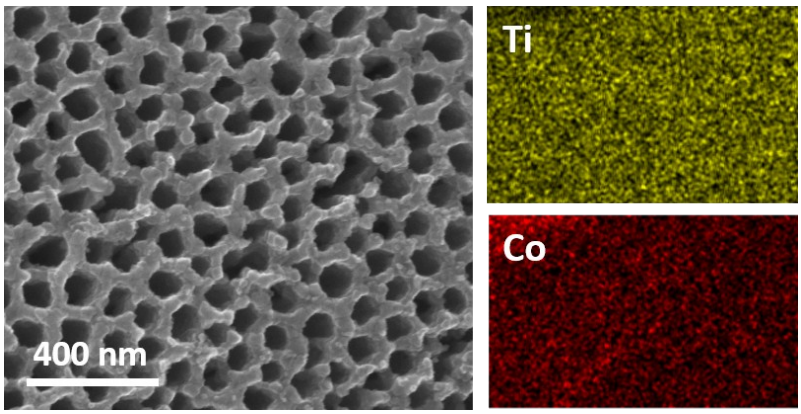


Fig. S5. SEM-EDX images of Ti and Co within Co-TNT sample.

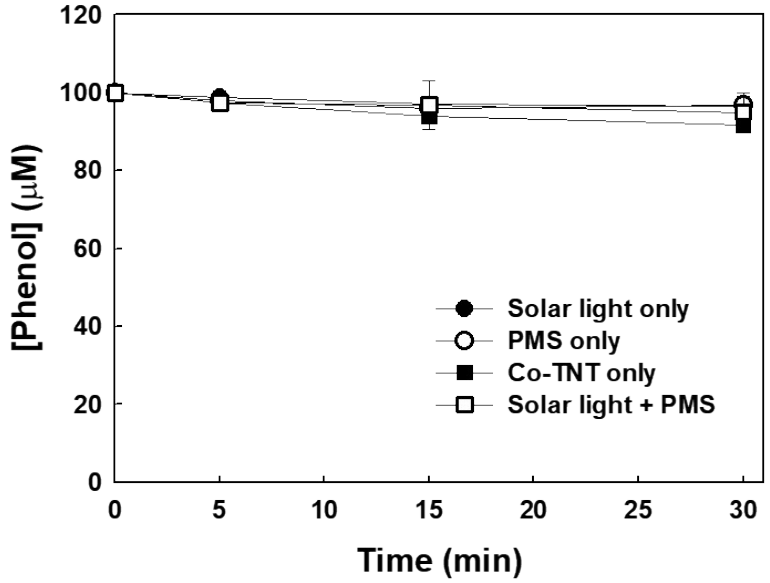


Fig. S6. Degradation of phenol on Co-TNT under various conditions ($[Phenol]_0$ = 100 μM; $[PMS]_0$ = 1 mM; $[phosphate\ buffer]_0$ = 3 vol %; pH_i = 7.0).

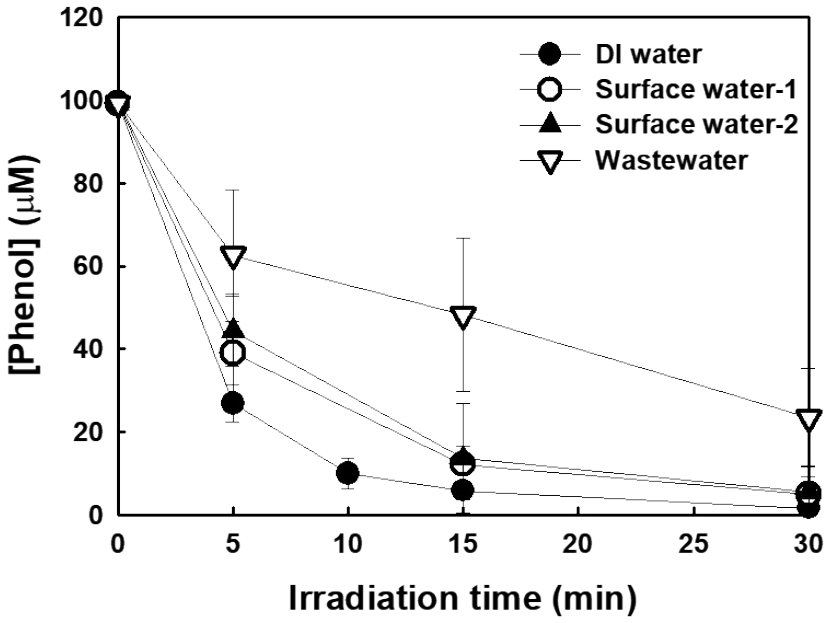


Fig. S7. Degradation of phenol on Co-TNT in actual surface water (obtained from several different places) and wastewater under simulated solar light irradiation ($[Phenol]_0$ = 100 μM; $[PMS]_0$ = 1 mM; pH_i = 7.0).

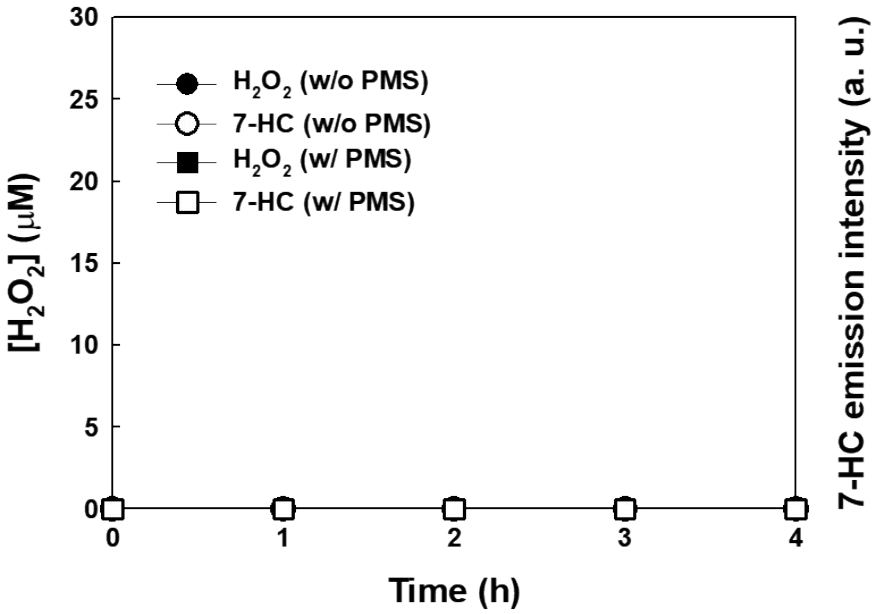


Fig. S8. Time profiles of H_2O_2 production and fluorescence emission intensity indicating the generation of 7-hydroxycoumarin (7-HC) as a coumarin-OH adduct in Co-TNT under the dark condition in the absence and presence of PMS. ($[Coumarin]_0$ = 1 mM (for 7-HC experiment); $[MeOH]_0$ = 100 μM (for H_2O_2 experiment); $[PMS]_0$ = 1 mM; [phosphate buffer]$_0$ = 3 vol %; pH_i = 7.0).

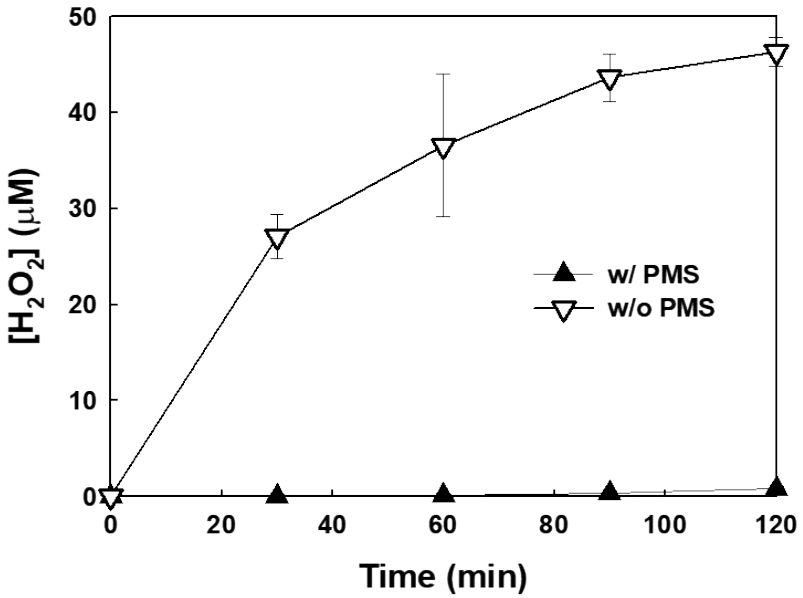


Fig. S9. Time profiles of H_2O_2 production in the Co-TNT/PMS system under simulated solar light irradiation in the absence and presence of PMS. ($[MeOH]_0$ = 100 μM; $[PMS]_0$ = 1 mM; $[phosphate\ buffer]_0$ = 3 vol %; pH_i = 7.0).

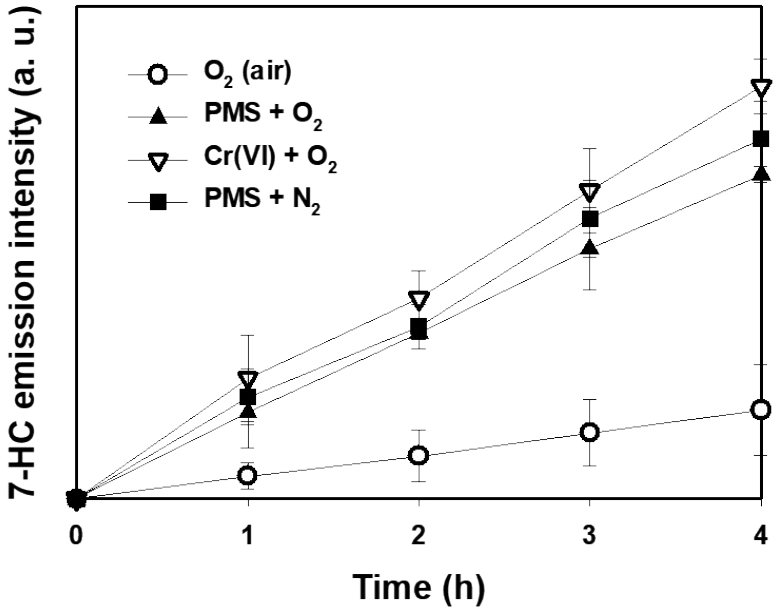


Fig. S10. Time profiles of fluorescence 7-HC emission intensity with Co-TNT under simulated solar light irradiation in the presence of electron acceptors (*e.g.,* O_2, PMS, and Cr(VI)). ($[Coumarin]_0$ = 1 mM; $[PMS]_0 = [Cr(VI)]_0$ = 1 mM; $[phosphate\ buffer]_0$ = 3 vol %; pH_i = 7.0; air-equilibrated condition except for N_2-saturated condition).

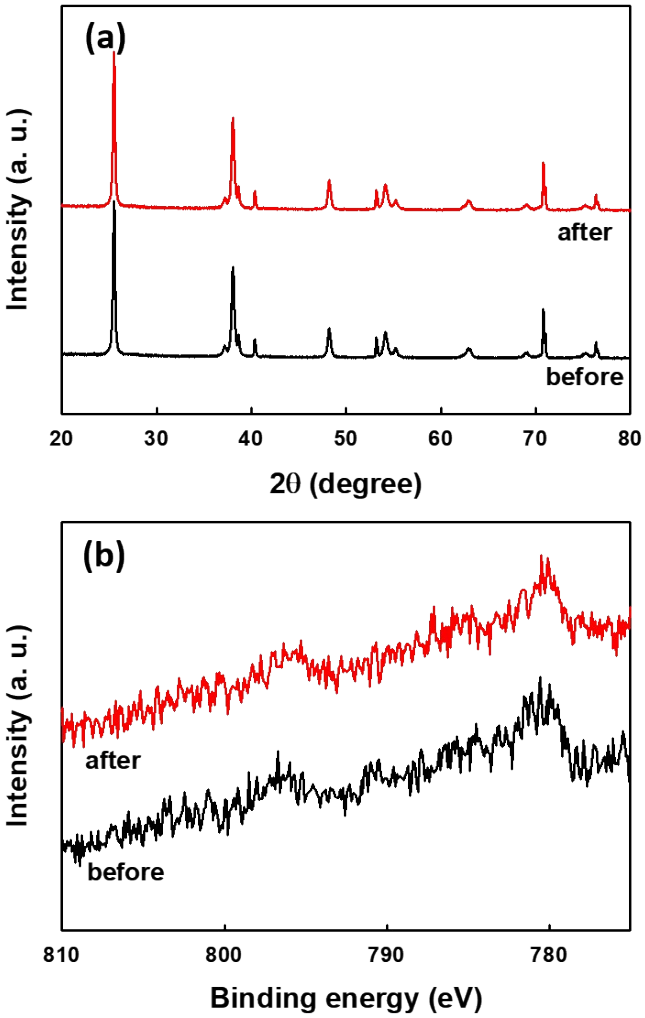
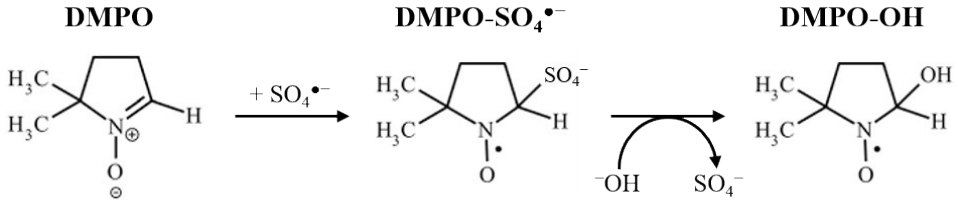


Fig. S11. (a) XRD patterns and (b) Co 2p XPS spectra of Co-TNT before and after reaction.

Condition	Initial pH	Dissolved Co concentration in the solution (mg/L)
In the dark	pH 3	0.004
	pH 7	0.002
	pH 9	0.002
Under solar light	pH 3	0.004
	pH 7	0.004
	pH 9	0.002

Table S1. The effect of initial pH on Co leaching from Co-TNT under dark and solar light.



Scheme S1. Transformation of DMPO-$SO_4^{\bullet-}$ adducts into DMPO-OH adducts.